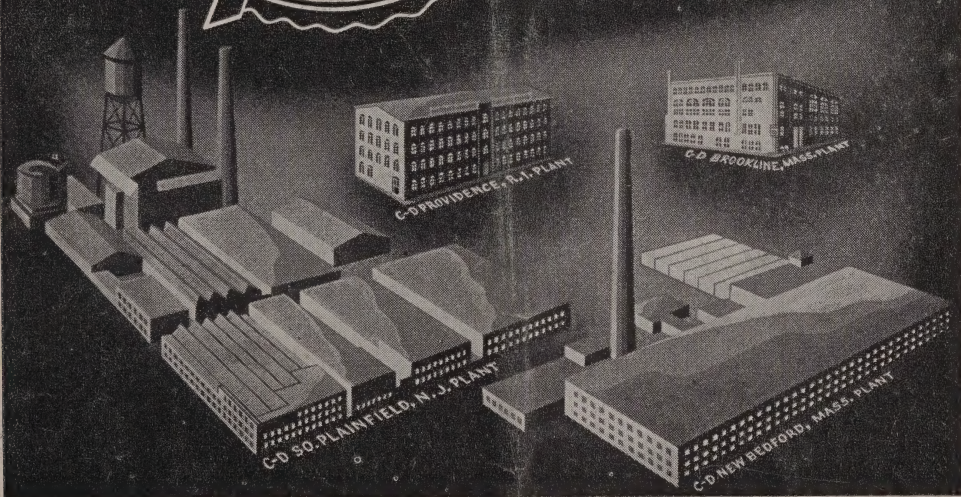


The CORNELL-DUBILIER Capacitor



Vol. 15

JANUARY, 1950

No. 1

CORNELL-DUBILIER ELECTRIC CORP.
Hamilton Boulevard, South Plainfield, N. J.

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Eliminates danger of lead breakage.

Only vibrator using pure ruby mica. Results in a stack that is superior to all other types.

Only vibrator available today equipped with this super-soft, pure sponge rubber sock. Designed to eliminate vibrations.

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For the best in vibrators insist on C-D's. Now at your local C-D distributor. Or write for full details to Cornell-Dubilier Electric Corp., Dept. HO79, South Plainfield, N. J. Other plants in New Bedford, Worcester, and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind.; and Cleveland, Ohio.

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1949

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CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
CAPACITORS

POWER FACTOR, DISSIPATION FACTOR, AND Q

Electronic circuits depend upon capacitors and coils to furnish reactance. In whatever form they may be, coils (or *inductors*) are expected to furnish inductance (L) or positive inductive reactance (X_L), and capacitors to furnish capacitance (C) or negative capacitive reactance (X_C). Except at ultra-high frequencies, all frequency-determining tuned circuits are selected combinations of these two kinds of reactance.

Although we work toward obtaining only reactance in capacitors and coils, a certain amount of resistance (R) is unavoidable in each. The resistance of a coil is due to the length of wire from which the coil is wound, and at radio frequencies also to skin effects, distributed capacitance, and the presence of dielectric materials and metal shields. The resistance of a capacitor is due to minute current leakage through the dielectric material separating the capacitor plates, resistance of the leads and contacts, and resistance of the plates themselves. It is important to note that the total resistance effect in a capacitor or coil is a component which is in phase with the applied voltage; or more specifically, the current due to the resistive component is in phase with the applied voltage. However, the so-called a. c. resistance (not to be confused with impedance) is composed of other factors than the simple "ohmic" resistance that is measured with a d. c. ohmmeter.

Modern engineering and manufacture strive to reduce the resistive component to negligible proportions in both capacitors and coils. A high resis-

tive component consumes power and accordingly introduces losses. It follows that since reactance is desired in a capacitor or coil and resistance is not wanted, a good way to determine the electrical quality of a capacitor or coil is to compare its resistance and reactance. This comparison can, and does take the form of a simple arithmetical ratio.

The entire resistive component with which we must deal in capacitors and coils cannot be measured in the simple direct manner that d. c. resistance can be checked with an ohmmeter. This is because the total resistance component is not easy to "get at" with simple meters. For instance, in a capacitor the most troublesome and loss-producing resistance is effectively in series with the capacitance. The value of the resistive component varies with operating frequency. It often has a value many times higher than the simple d. c. resistance. Resistance of this sort must be appraised indirectly. Various measuring instruments evaluate the resistance, as it occurs in combination with reactance, by means of such indirect measurements. These instruments appraise capacitor or coil quality by measuring resistance-to-reactance ratios. The common ratios employed are what we have named *power factor*, *dissipation factor*, and *Q*. Since each of these factors is widely used at present and subject to some confusion among workers with limited engineering background, this article aims to explain the meaning of each.

Power Factor

Power factor (p. f.) is the ratio of reactance to impedance and is indicated

by R/Z . Impedance Z is the vector sum of the resistance and reactance and is indicated by $\sqrt{R^2+X^2}$. (In the symbols of complex algebra, this may be written also as $Z = R + jX$. Thus, power factor is equal to $R/\sqrt{R^2+X^2}$. In the case of a capacitor, the reactance X_c is negative, and the expression under the square root radical becomes R^2+X^2 . Numerically, power factor is equal to the cosine of the phase angle; that is, the angle formed by the resistance and reactance components when drawn as vectors.

A large number of a. c. bridges measure the power factor of a capacitor by means of a resistance balance adjustment made independently of the capacitance balance. A very few bridge circuits attempt to appraise the power factor more or less qualitatively by observing the completeness of the capacitance null, the larger the voltage at complete null, the higher the power factor.

A good capacitor shows a low power factor value. Air capacitors and high-grade mica and ceramic capacitors show as small as a few hundredths to a few tenths of one percent power factor, while wax, paper, and oil capacitors normally give higher power factor readings. Electrolytic capacitors show the highest power factors of all, extending to several percent. For a given type of capacitor, the higher-capacitance units will give higher power factor indications than the lower-capacitance units in the same group.

Power factor varies with frequency and to some extent also with temperature and applied voltage. Low power factor values often are as important as correct capacitance values in determining the condition of capacitors. Radio

men have made this observation repeatedly in the case of electrolytic filter capacitors. Power factor is not ordinarily used in rating coils.

In order to determine intelligently the condition of a capacitor in terms of power factor, the technician must have some acquaintance with the manufacturer's specifications for the capacitor. No arbitrary limiting figures can be set up for all cases. A certain power factor value may represent an excellent rating for one particular capacitance but may be a reject point for a different capacitance. Also, in the case of a given capacitance a certain power factor value may represent top quality at one frequency but would be a reject point at a different frequency. This is understood readily when we remember that reactance X enters into power factor calculation and that reactance depends upon frequency.

Dissipation Factor

Several professional, laboratory-type a. c. bridges give indications of quality in *dissipation factor* (d), rather than power factor. Question often arises in the mind of a new user as to relation of d to $p. f.$

Dissipation factor is the ratio of resistance to reactance and is indicated by R/X . Numerically, dissipation factor is equal to the cotangent of the phase angle.

Up to about 10%, dissipation factor and power factor are approximately equal. Thus, at the small values encountered in non-electrolytic capacitor measurements, a bridge giving dissipation factor indications shows essentially the same figures as one giving power factor indications. For that reason, it makes little difference whether

a capacitance bridge reads power factor or dissipation factor.

Dissipation factor of a good capacitor is, like power factor, small. Dissipation factor, again like power factor, is expressed either as a decimal or a percentage. Dissipation factor varies with frequency, temperature, and applied voltage. This unit ordinarily is not used in rating coils.

Q Value

The *figure of merit* or *storage factor*, Q , is used in rating both capacitors and coils. Some technicians find this unit more convenient to use, since a large value of Q indicates a good capacitor or coil. Furthermore, Q values are greater than 1, in contrast with power factor and dissipation factor values which always are decimals or percentages.

Q is the ratio of reactance to resistance, which is just the opposite of dissipation factor, and is represented by X/R . When Q is 10 or higher, it is equal to $1/d$, the reciprocal of the dissipation factor. It also is equal closely to $1/p. f.$ Thus, a dissipation factor of 0.0001, which is stated as 0.01% power factor, corresponds to a Q of 10,000.

It is impossible to set high and low Q values to satisfy all cases, since the Q factor, like power factor and dissipation factor, varies with frequency and with the size of inductance and capacitance. A certain Q value may be acceptable for a given capacitance or inductance at a particular frequency, but the same value might be the basis for rejecting the component at a different frequency. For a given capacitance, Q will decrease as the frequency increases, assuming slowly increasing resistance

losses. At a fixed measurement frequency, Q will be higher for low capacitances. For a given inductance, Q will increase with frequency, assuming slowly increasing resistance losses. And at a fixed measurement frequency, Q will increase with inductance up to the point where increasing resistance losses become significant.

The technician will be unable to determine which are acceptable Q values for capacitors or coils under test unless he has some acquaintance with manufacturer's ratings for these components, or unless he is able to make comparison measurements with similar components of known quality.

The Q value obtained for a spaced-turn coil will be higher than for a close-wound coil of the same inductance and same approximate physical size. Q will be higher also for a coil wound with Litz wire than for one having all other similar characteristics but wound with solid conductor. At high radio frequencies, a coil wound with large-diameter solid conductor or tubing will show higher Q than one of similar characteristics wound with smaller-sized conductor. An air-wound coil, or one wound on a form of high-grade dielectric material, will exhibit higher Q than one wound on poorer insulating material. At the lower radio frequencies, universal- or honeycomb-wound coils frequently are used. These coils show a higher Q value than single-layer coils having the same inductance.

While apparatus occasionally is set up for checking Q at audio frequencies, Q measurements customarily are made in the radio-frequency spectrum. Commercial Q -meters are convenient for checking the radio-frequency characteristics of both capacitors and coils.

TABLE 1

$$\text{POWER FACTOR (p.f.)} = \frac{R}{Z} = \frac{R}{\sqrt{R^2 + X_C^2}} = \frac{R}{\sqrt{R^2 + \left(\frac{1}{2\pi fC}\right)^2}}$$

WRITTEN
AS A
DECIMAL
OR
PERCENTAGE.

$$\text{DISSIPATION FACTOR (d)} = \frac{R}{X} = 2\pi fCR$$

WRITTEN AS A
DECIMAL
OR PERCENTAGE.

$$Q = \frac{X}{R} \quad \text{FOR A CAPACITOR, } Q = \frac{1}{2\pi fCR}$$

$$\text{FOR A COIL, } Q = \frac{2\pi fL}{R}$$

WRITTEN AS
A NUMBER
GREATER THAN 1.

• RELATIONSHIPS •

$$\text{DISSIPATION FACTOR (d)} = \frac{1}{Q}$$

$$Q = \frac{1}{d}$$

POWER FACTOR (p.f.) = d for small values

POWER FACTOR (p.f.) = $\frac{1}{Q}$ for small p.f. values (Q's of 10 or higher)

$$Q = \frac{1}{\text{p.f.}} \quad \text{for small p.f. values (Q's of 10 or higher)}$$

C is expressed in the above in farads,

f in cycles per second, L in henries, R in ohms,

X in ohms, Z in ohms, $\pi = 3.1416$

Measurement Frequencies

It is desirable to check power factor, dissipation factor, and Q at the frequency at which the capacitor or coil under test normally will be operated. When a capacitor is to be used over a wide band of audio frequencies, it is customary to check power factor or dissipation factor at 1,000 cycles per second. For certain other applications at low frequencies, the measurements are made at 60 or 120 cycles. Q customarily is measured at the actual radio frequency at which a capacitor or coil is to be used; and when no specified operating frequency is stated, the measurement usually is made, when possible, at 1,000 kc. and sometimes at 10 megacycles.

Available Instruments

Capacitance, inductance, and impedance bridges are provided with separate balance controls which give indications of power factor or dissipation factor, and sometimes Q as well. (See *A. C. Bridges*, C-D CAPACITOR, February, 1949). In a few bridges, the indicating dial reads directly in equivalent series resistance (R) which may be substituted in the formulas given in Table 1 to compute power factor, dissipation factor, or Q . Most of these bridges operate at a 60-, 120-, or 1,000-cycle signal frequency derived from an oscillator or from the power line. Occasionally, a 400-cycle test frequency is employed.

When a bridge control dial is graduated to read directly power factor, dissipation factor, or Q , the indications will be true only at the bridge signal frequency at which the calibration originally was made.

Radio-frequency bridges and other null-network instruments are available

which operate at any radio frequency within wide limits (usually supplied by an external r. f. signal generator) and provide indications of equivalent series resistance from which power factor, dissipation factor, or Q may be calculated.

The power factor of a high-capacitance a. c. motor starting capacitor (and also of electrolytic capacitors of the common sort) often is measured by means of a combination of a. c. voltmeter, ammeter, and wattmeter. This method is described in the article *Testing A. C. Motor Starter Capacitors* in the December, 1948, issue of the C-D CAPACITOR.

Commercial Q -meters are available for operation at both audio and radio frequencies, although the r. f. type of instrument is the better known and perhaps most widely used. The r. f. Q -meter may be used to check capacitors and coils for capacitance and inductance, as well as for Q . This instrument gives direct indications of *effective* Q , from which true Q may be calculated easily by reference to the settings of the resonating dial. The test signal is supplied in the Q -meter by an internal band-switching r. f. power oscillator.

Interrelation of Units

The accompanying Table 1 will serve to show how power factor, dissipation factor, and Q are related to each other. In general, if one unit may be measured, the other two may be determined by simple calculations involving the first known. The degree of accuracy will, of course, vary with the magnitude of the factor, but will be satisfactory for most purposes, especially when the values of power factor are low (Q high).



A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate WANTED, SELL, or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

FOR SALE—Cooke radio slide rule, never used, complete with instruction books, \$10. James Lees, 30 Park Lane, Rochester 10, N. Y.

SWAP—6-volt and 12-volt motor generator, Weston photo cell and Microrelay-Abbot TR4. Silver 701 and 802 receiver and transmitter. Equip. for manufacture of television antennas, 813 and Hivoltage power supply. 28 volt motor. Leo Meister, 1526 Schley St., Hillside, N. J.

FOR SALE—Triplett Model 625-N Dual Sensitivity Multimeter, like new, best offer. Royal Quiet Deluxe portable typewriter, used less than week. Cost \$95.08; sell for \$80. John T. Moore, Box 63, Seneca, S. C.

FOR SALE—Triplett model. 1175-B multimeter and signal generator. 130Kc to 28Mc. O-1500V. AC-DC, O-15A., O-20 Meg. in various ranges. \$35 FOB. L. E. Bollinger, 45 McMillen Ave., Columbus 1, Ohio.

POSITION WANTED—Young man attending college in Washington, D. C. desires pos. as radio mechanic or CW opr. Four years exper. on radar radio and sonar. CW speed 45 receiv., 40 send. Don Fairweather, 1216 Methuen St., Dracut, Mass.

FOR SALE—Meissner Analysts, like new, originally \$115, our price \$40. Heathkit oscilloscope model O-3, like new, wired, \$35. Feiler signal tracing analyzer, battery oper., mdl TS-2, like new, \$12.50. W. C. Berman, 1188 Broadway, Brooklyn 21, N. Y.

SELL OR TRADE—Two Kenrad and 1 Sylvania 307A tubes, new, slightly shopworn. What have you? James Casto, 31 Marshall Ave., Atlantic City, N. J.

FOR SALE—Speco signal tracer, new condition, \$22.50. Weston 20,000 ohms per volt Vom, model. 772, \$20. Want good capacitor analyzer. Robert Bomboy, 3429 Maple St., Progress, Harrisburg, Pa.

WANTED—New or in very good condition. Cabinet for GE mdl 106 table combination. State price and condition. Keemer Radio Service, 226 Merrimon Ave., Asheville, N. C.

FOR SALE—Hallicrafter receiver, model SX42, with speaker mdl R42. Used 1 yr. In perfect cond. \$275. Norman Pineau, Sr., 119 W. 45 St., New York 19, N. Y.

FOR SALE—Wire recorder foundation unit and oscillator coil, \$20. BC223AX with 80 mtr. tuning unit, new, \$15. McMurdo Silver Masterpiece III, \$18. BC-221 Freq. Meter, crystal, \$35. BC 375, \$15. Wm. D. Glenn, Hamilton Square, N. J.

POSITION WANTED—Electrical engineer with MS in EE degree, 8 yrs. exper. as instructor in radio physics, lab. engin. desires similar pos. in college or vocational school. Prefer Calif. Leland Cox, P.O. Box 1481, Honolulu, Hawaii.

FOR SALE OR TRADE—Outboard motor, Waterwitch 3 1/2 h.p., perfect cond. Will trade for TV set, any size, good cond. Fred Mergard, 2331 N. Hancock St., Phila. 33, Pa.

(Continued on page 11)

Opening DC areas for big-screen television sales!

C-D POWERCON CONVERTERS

Input: 110 Volts DC

Output:

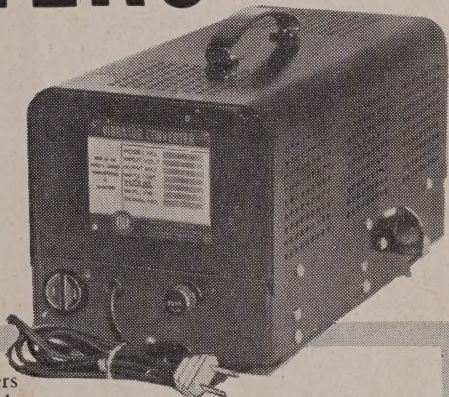
110 Volts 60 cycles AC

110 RT 15 (Rated at 150 watts)
For TV sets with screens up to 10"

110 RT 25 (Rated at 250 watts)
For TV sets with screens up to 12"

110 RT 35 (Rated at 350 watts)
For TV sets with screens up to 16"

Also a complete line of DC to AC,
AC to DC Converters for Marine,
Farm, Transportation, and Record
Player Purposes.



Here are three special TV Converters that make trouble-free television installations practical in areas with 110 V. DC current. Thousands have already been installed by TV service organizations, on sets with screens as big as 16".

All three models are completely RF filtered for TV reception, as well as for FM, AM and short wave. 110RT15 and 110RT35 feature the "Phantom-switch"—automatically controlled by "off-on" switch on TV set. (For

110RT25, there is a plug-in "Phantom-switch" available.)

Service men in 110 V. DC power areas will be wise to carry at least one of these TV Powercons in stock at all times. If your jobber does not have them, write: Cornell-Dubilier Electric Corp., Dept. HO10, South Plainfield, New Jersey. We will ship your order through your nearest C-D distributor.

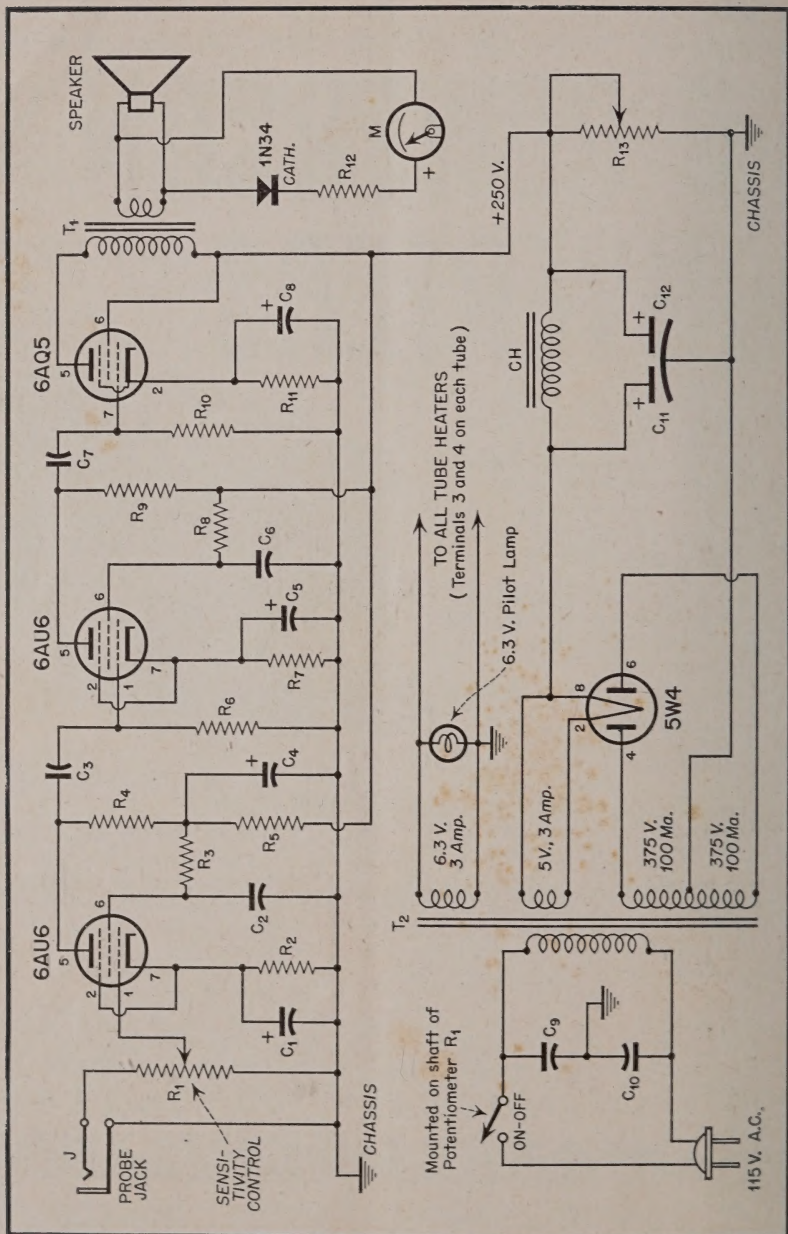
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CAPACITORS • VIBRATORS • ANTENNAS • CONVERTERS





THE RADIO TRADING POST

(Continued from page 8)

TRADE—Want 1935-'40 issue of any season Sears Roebuck General Catalog. I have tubes, ass't. parts, Radiocraft, News magazines. John Moy, Box 169, Canal St. Sta., New York, N. Y.

FOR SALE—ICA Delux Signatone-3 output freq. audio oscillator and transmitter keying monitor with built in speaker. Complete with tube and speed-x heavy duty chrome telegraph key. \$10. Otto Pollei, Jr., 118 No. Western Pkwy, Louisville 12, Ky.

WANTED—Used 6v batt. eliminator. Send best offers to Daniel Rosa, 590 Eagle Ave., Bronx 55, N. Y. C.

FOR SALE—Supreme, mdl. 502 tube tester and set tester with all manuals, tube check sheets, miniature and Loctal tube adapters. First \$50 takes it. Albert Hart, 4848 Linden Ave., Hammond, Ind.

WANTED — Riders Manuals and Sam's Photofacts. Sprague Telemike, RCA Chanalyst. Must be good cond. Donald R. Potter, 1615 4th Ave. S.E., Cedar Rapids, Iowa.

FOR SALE OR TRADE—Hickok conductance tube tester mdl. 532, \$65, or trade for Hickok 5" scope or Riders chanalyst in good cond. Triplet mdl. 2432 signal generator like new, \$45; Hickok 209 lab. type elect. multitester, like new, \$80. R. P. Voorhies, PO Bx 588, New Iberia, La.

WANTED—Riders Manuals vols. 1-3, 5, in good cond. Will pay cash. Robert Cole, 163 E. 3rd South, Logan, Utah.

SALE OR TRADE—Best offer takes like new Underwood portable typewriter, NC-57 receiver, RCP-802N and Supreme 599 tube and set testers, dictionary, pistol, automatic rifle, etc. Trades considered. Want Eimac tubes, 810's and 805's. Eddie Howell, 1720A Martin Ave., Anderson, S. C.

SALE OR TRADE—Triplet sig. gen. mdl. 2432, cost \$90, good cond., for \$40 or watch repairing parts or tools. Mark Skaro, 142 W 83 St., New York 24. N. Y.

FOR SALE—Riders I, II, III. \$5 takes all three. I. Horowitz, 1781 E. 16th St., Brooklyn 29, N. Y.

— ERRATA —

Through error in the December 1949 issue, cuts of diagrams, figures 2 and 3, were incorrect. Correct diagrams of the High-Sensitivity AF-RF Signal Tracer are shown below and on the preceding page.

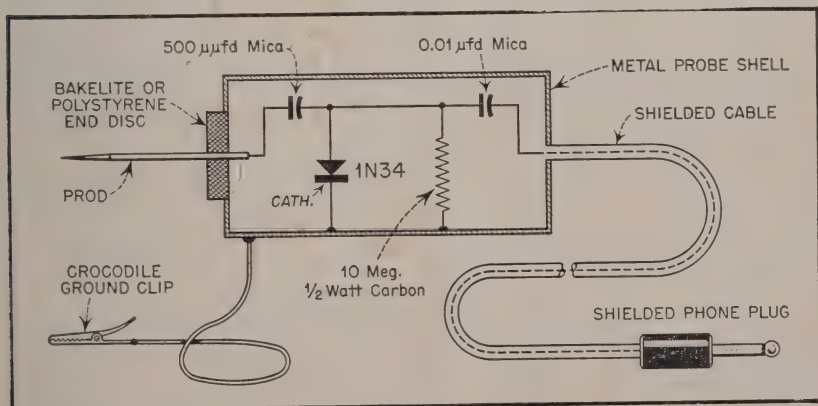


Fig. 3

SELL OR TRADE—German Luftwaffe aircraft receiver mdl. E-10a-K, all metal, size 8"x8"x7", 6 extra tubes (No. RV-12-P2000). Offer or swap for firearms, photographic equip., phonograph, modern standard law bks. Armand A. Korzenik, Kirkland House H-42, Cambridge 38, Mass.

TRADE—One Feiler stethoscope signal tracer, mdl. TS-3, like new. Want capacitor analyzer or S-38 Hallicrafters receiver, or what have you? All replies answered. R. W. Peters, R.D. 2, Massillon, Ohio.

WANTED—Recent, complete home radio-TV course such as National Schools or N. R. I. Must include all kit material in good cond. Will pay \$35. M. S. Budd, 500 So. Crouse Ave., Syracuse, N. Y.

SWAP—Like new Weston dry-type photo cell, also Weston micro relay for same; TR4 2 meter transmitter receiver, like new 6v-12v, 28v motorgen. hivolt. power supply. Meck T60-1 transmit. Want wire recorder or ham, photo gear. Leo Meister, 1526 Schley St., Hillside, N. J.

SELL OR SWAP—Many back issues of Radio News, Radio Craft, Popular Science, odd issues of other magazines, mostly from 1940-48, \$10 apiece and postage or trade. James O. Pullman, 834 Edison Ave., Detroit 2, Mich.

FOR SALE — '41 Studebaker pushbutton Philco car radio, 1 unit, complete with roof antenna. Ex. cond., \$27. Table mdl. car radio, '35 Ply. head, like new 6" speaker, \$23. W. Larson, 2617 Franklin Ave., Seattle 2, Wash.

FOR SALE—Buick auto radio, push button, 1939-'40 Buick. \$35. R. Lovko, 1430 E. 55th St., Cleveland 3, Ohio.

SELL—Mark II complete with power supply, canvas cover, mike, phones, shock mount, power cable, ant. tuner, like new unconverted, all tubes, sells \$60 surplus, my price \$50. G. F. Gnanot, Creek Valley Park, Wellington, Ohio.

FOR SALE — 1947 Firestone auto radio (Farnsworth made) 6 tubes, single hole mount, 6" speaker (in set), 6 x 5 rect. complete with antenna, tuning unit, cables, etc. very good cond. Best offer over \$25. Guy Maken, 34 Metropolitan Oval, Bronx 62, N. Y.

SELL OR TRADE—National NC81X receiver, 10 to 160 meter amateur bandsread mdl., excell. cond. Want oscilloscope or hi-fi equipment, Freund, 21-22 78th St., Jackson Heights, N. Y.

WANTED—16mm movie camera, Eastman mdl. K with 1.9 lens. Will pay cash. Also have radio parts and tubes. Anton Cindel, 225 Naples Ter., N. Y. 63, N. Y.

TRADE OR SELL—Edison's 1st home gramophone with tin horn, 20 cylindrical-type records, permanent diamond point needle, portable, plays. Want TV set or sound projector. Fred Simonian, 85 Shepard St., Lynn, Mass.

SALE OR TRADE — 522 transmitter, like new, less 832's, \$15. Will accept AC-DC new tubes in payment or test equip. FOB. 832's available here, \$3.50 each. Capitola Radio & Appliance, Capitola, Calif.

WANTED — Electrical, radio text books. Need elem. radio correspond. course for publication on royalty basis. Bob's Radio and Appliance Service, Box 1824, Rt. 4, South Miami, Fla.

FOR SALE—Superior signal tracer, mdl. CA-11, less batteries, best offer takes it. Alvin Sydnor, 3010 Arlington Ave., Chester, Pa.

FOR SALE—Riders manuals, 1-13, excell. cond. \$130. Toney Armad, 701 Hogan St., Houston 9, Texas.

FOR SALE—Gibson girl radio xmtr., like new, unused surplus, with parachute and carrying bag. Cost me \$9.95, will sell for \$5, FOB. V. R. Hein, 418 Gregory St., Rockford, Ill.

FOR SWAP—Helicrafters S38, 9 mos. old, for Sig. Gen. v-ohn meter or other test equip. Send description and what you will give. J. R. Bowers, 2326 Taylor Ave., Columbus, Ohio.

RADIO STORE FOR SALE — Established business, like new equipment, good location, low rent, must sell at once due to illness. Reasonable. Harry's Radio Service, 7019 Indiana Ave., Cleveland, Ohio.

WANTED—Information on conversion of BC-733-D and SCR 518 receivers. Would like to hear from amateurs and experimenters on 420 mc conversions. R. Holzman, 7076 Hyde Ave., Detroit 11, Mich.

WANTED—Command set transmitter and receiver and modulator, '40, 80 meters. Will swap 811, 813 tubes or ART13 modulation transformer for same. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Ala.

WANTED—A complete set of Riders manuals. Will consider any complete volume. Irv's Electrical Shop, Ingalls, Kan.

SELL OR SWAP—CREI course complete.

Sect. 1-2 and broadcast plus TV sect. cost \$300 new. Want good used communications receiver or what have you in ham gear? M. M. Sansig, 40-A Smith St., Avenel, N. J.

FOR SALE—At \$.70 ea. post paid the following first quality tubes: 35Z5, 70L7, 12SQ7, 12SK7, 354, 155, 80; following at \$.75 ea. 50L6, 35L6, 42. Free tube tapper with first order. Jones Radio Company, Box 93, Douglassville, Pa.

WILL TRADE—A NC-57 receiver like new (used 40 hrs.) for a new BC-221 freq. meter with calibration book and crystal. J. N. Richards, 99 Arcadia Ave., Plainville, Conn.

WANTED—Correspondence course (radio-TV) with answers, NRI, CREI or what have you? Want equipment and testers. Max C. Simon, 8625 162 St., Jamaica 2, N. Y.

WANTED—Power transformer for View-tone VP-155D, 2.5 KV Winding (high v.), 2.5 v. wind. for 2 x 2 tube, 6.3 v. wind. for CR tube, 500 0-500 for plate supply, (150 MA); 5 v. (150 MA) rect. filament, 6.3v-0-6.30v for fila. supply. H. E. Binning 23638 Wilson Ave., Dearborn, Mich.

FOR SALE OR TRADE—Modern radio servicing and radio physics course. Both by Ghirardi. All offers considered. Harry Chu, 110 Mulberry St., N. Y. 13, N. Y.

FOR SALE OR SWAP — Precision tube checker mdl. 912, Precision 840 VOM, 100 tubes in original cartons. Want phono or photographic equip. Michael Gulas, 1216 N. 17th St., Clarksburg, W. Va.

FOR SALE—BC453 Q5ers, new with tubes. Motor generators free to first buyers. \$15 plus post. Will trade 1 for BC459 if new and not convert. or altered. G. N. Schafer, 4217 Woodland, Kansas City 4, Mo.

WANTED—BC-221 or LM freq. meter with original calib. book. Don't need power supply but want schem. of meter. Want Aerovox 95 LC checker. State price, cond. J. W. Firdarle, Rt. 1, Box 1061-G, Modesto, Calif.

WANTED — RME-45, DB-22A, VHF-152, VHF2-11, give cond. age, price. Fred Dillion, 1461 N. Poinsettia Pl., Hollywood 46, Calif.

FOR SALE—Sig. Gen. and multimeter. Also a few radios. Gene Mick, P.O. Box 1, Buckingham, Pa.

WANTED TO BUY—Transmitting, receiving type tubes in large or small quantities. Turn your excess into ready cash. E. N. Gensler, 162 Greenwich St., New York 6, N. Y.

FOR SALE—Al condition, Vibroplex "Blue Racer", black base, carrying case, \$10.95, originally \$22.95. J. G. Peters, 601 Highland Way, Hagerstown, Md.

SALE—5" scope for FM, AM, TV servicing \$50, never used, lab. tested (mdl 400-EICO). High precision vacuum tube voltmeter, \$32 (mdl 221). General Radio & Elect. Service, 167 Ablett Village, Camden 5, N. J.

FOR SALE OR TRADE—Post slide rule 1462, complete with case, instruction book, good cond. New value, \$10. A. C. Swanson, 515 W. Babcock, Bozeman, Mont.

FOR SALE—Army BC 342 N, 110v AC, rcvr 1.5 to 18.0 mc., \$65; \$5 extra for LS3 spkr.; Navy 602A-R1, 2 meter, radar grounded grid RF pre-amplifier, uses 2-446 A 'Lighthouse' tubes, like new \$25. Morrison, 383 N. Grove St., E. Orange, N. J.

WANTED—Riders Manuals 9, 10, 12-18, Solar Exam-Eter CF-1-60, Silver 900A Vomax and 905A Sparx. State prices, cond. Harold Zvacek, RR 2, Cedar Rapids, Iowa.

FOR SALE—Meissner portable 7-tube radio phono., dual speed recorder priced for quick sale. Joe Confino, 3130 Nostrand Ave., Brooklyn 29, N. Y.

FOR SALE OR TRADE—Mdl. 564 Weston meter, Simpson mdl. 260 meter, Precision tube, set tester, mdl. G954, mdl. EV10 Precision V.T.V.M. meter, mdl. 22A Ferris generator, output meter. Need cash, 8mm projector. Harry Levine, 2231 E. 7th St., Brooklyn 23, N. Y.

WANTED—TV set, enlarging lens, 7" 7EP4 or tube. Will trade transmitter & radio, test equip., piano accordion for any of above. John Arnold, Box 84, Bluffs 3, Ill.

FOR SALE—Best offer takes 400 6AB7 tubes, 200 6H6 tubes. Bulk pack f.o.b. San Francisco, Associates Inc., 1797 Union St., San Francisco 23, Calif.

FOR SALE—Shure high impedance "Stratoliner" mdl 508C, Dynamic mike complete with 25' cable, Atlas chrome-plate desk stand, adjustable. A-1 shape. \$15. Otto Pollei, Jr., 118 N. Western Pkwy., Louisville 12, Ky.

FOR SALE— $\frac{1}{4}$ 32v motor, Superior generator mdl. 1130-S. Best offer buys them & used radios. E. Kiehnhoff Radio Service, Box 355, Wathena, Kan.

FOR SALE—Webster 80 wire recorder, \$100. Web. 255 two speed changer, \$35. Never used. Gordon E. Hopper, 301 Hollis St., Framingham, Mass.

FOR SALE—3 tube AC-DC Meissner regenerative receiver with tubes, coil, \$5. F.o.b. Brooklyn. Coils for 10-2,000 meters. Dr. Alan York, 1342 40th St., Brooklyn, 18, N. Y.

FOR SALE OR TRADE—Transmitter rack, dolly. Panel has cutouts for four $3\frac{1}{2}$ " meters, made of heavy gauge steel. A. Miller, 1075 Bryant Ave., Bronx 59, N. Y.

SALE—Transvision TV set, 7" tube & magnifier. Perfect cond. Greiner Radio Service Co., 299 S. Elmwood Ave., Buffalo, N. Y.

WANTED—Used Precision voltmeter mdl. 864. State price, cond. Precision Radio, 2 N. Quincy St., Brockton 58, Mass.

FOR SALE—RCA TV set 10" screen mdl. 8TS30, perfect cond. 30 tubes, mohog. cabinet. S. Katz, 1050 Longfellow Ave., Bronx 59, N. Y.

SELL OR TRADE—Riders manuals, abridged, 1-5, 9-17—12% off of list. Trade for UHF test equip. M. W. Nelson, 3750 E. Main, Columbus, Ohio.

FOR SALE—Mdl. 704 RCP signal gen. manuals, parts. Send for list. All for \$75 c.o.d. Must take all. Grant LaMaye, 1864 D Apt. 4, Buffalo Rd., Erie, Pa.

WANTED—10 meter Gonset converter. A. Freitag, 1437 Patapsco St., Baltimore 30, Md.

WANTED—To contact any recent graduate of DeForest's Institute in order to purchase certain lessons in radio communications. Rudy Cuccinello, 422 Crescent Ave., Chelsea, Mass.

FOR SALE OR TRADE—Howards Sams Foto Fact folders 1-58 with heavy binders, sell for first \$90. Money order or what have you in ham gear? Triangle Radio Service, Breckenridge, Minn.

WANTED—Antenna coil for Motorola car radio mdl. 400. Parts of coil 1X17828. Coil urgently needed. All inquiries answered. Lew Wollaston Radio, PO Box 447, Alliance, Neb.

SELL OR SWAP—SX-9, Hallicrafter receiver, good cond., \$25. Code practice osc., \$4. QRM elim. as per June '49 CQ mag., \$29. Lionel auto. bug, \$14. Hard to get replacements, \$1 apiece. J. O. Pullman, 834 Edison Ave., Detroit 2, Mich.

TRADE—Cine master II 8mm movie camera, telephoto lens, Skan expos. mtr., tripod, etc. Want Harvey TBS50 XMTR-Collins 310C2 Exciter-HT18 exciter-Gonset 3/30 converter-RME VHF152A convert. W. M. McDonald, Bx 845, Pawtucket, R. I.

SWAP—813 xtal control rig, 125 watts. Want Silver McMurdo 801 or 802 receiver (or similar) with coils 80 & 40, or signal generator. R. A. Williams, RFD 1, Box 210A, Redlands, Calif.

FOR SALE OR TRADE—Two AN ART-13 transmitters with tubes. Want cash or equivalent. Gene Pfeiffer, 522 Hollins Ave., Helena, Mont.

WANTED—Answers to DeForests training course, nos. from RRT14 to final exams. Quote price. Rene Goodman, 363 Willoughby Ave., Brooklyn 5, N. Y.

WANT—Relay racks, enclosed 6' type, other radio items. Will trade guns, typewriters, watches, cameras, projectors, binoculars, etc. Send list. Ed Howell, Dillon, S. C.

SELL OR TRADE—Esco motor generator 110v.60c. AC motor. 500v. 300 MA compound wound gener. ball bearing (pig type), like new. Want MM2 modulation monitor as Lambda Elect. Co. basic scope. A. P. Rabito, 2835 Paris Ave., New Orleans 19, La.

SALE—Universal bridge to measure cap., Ind., and Res. General radio AC-DC bridge. L & N wall galvanomtr. type R with almp, scale. BC 221 freq. meter. All A-1 cond. Henry Wagner, 4411 Indianapolis Blvd., E. Chicago, Ill.

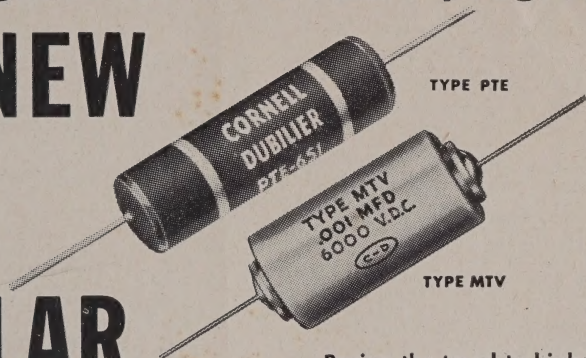
FOR SALE—Bradshaw multimeter mdl. 30 good cond. Has 17 ranges less 0-1 Mill. meter. All inquiries answered. Albert Miller, 1075 Bryant Ave., N. Y. 59, N. Y.

SALE—Used tube tester with up-to-date chart. Condenser tester A-1 shape with instructions. \$30 for both. 2-way intercom set, \$20. Reinisch Radio Service, New Rockford, N. D.

WANT—Used condenser tester, used sound systems, RCP 710 signal generators. Have few elect. hand drills, \$11.80 new. F. Cabon, 1504 La Baig, Los Angeles, 28, Calif.

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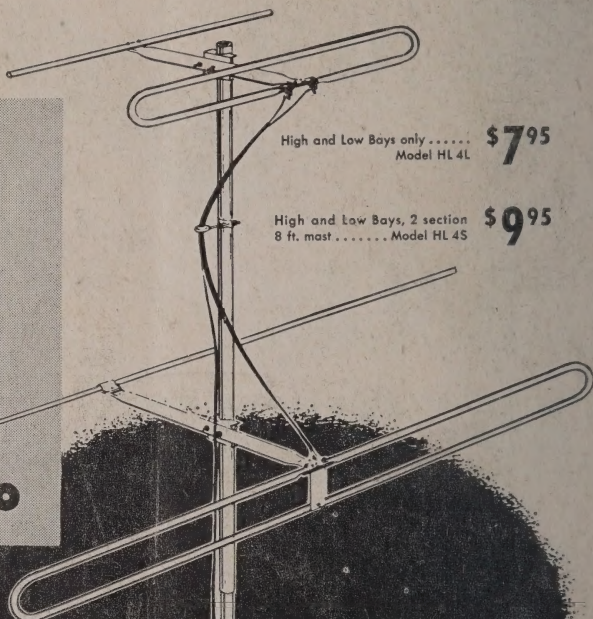
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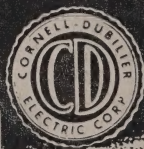
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